

Claims

1. An apparatus for positioning labels among graphical elements on a computer graphics display, comprising:

a display, and

5 a processor coupled to said display and operable to identify at least a first cluster of overlapping labels on said display, and operable to calculate new display coordinates for at least one label in said cluster and to move said label in accordance with said new display coordinates.

2. The apparatus of Claim 1 wherein said processor is operable to sequentially select labels from a plurality of labels on said display, and to test each of said selected labels for overlap with other labels or graphical elements in said display, and, said processor is operable to accumulate an overlap score for each of said selected labels, and, 5 operable to generate a list of other labels and graphical elements that overlap each of said selected labels, and operable to compare a plurality of said lists and accumulate cluster lists of overlapping labels and graphical elements, and operable to sort a plurality of said cluster lists according to the number of entries in each.

3. An apparatus for positioning labels among graphical elements on a computer graphics display, comprising:

means for identifying at least a first cluster of overlapping labels;

means for calculating new display coordinates for at least one label in said cluster;

5 and

means for moving said label in accordance with said new display coordinates.

4. The apparatus of Claim 3 wherein said means for identifying further comprises:

means for sequentially selecting labels from a plurality of labels on the display;

5 means for testing each of said selected labels for overlap with other labels or graphical elements in the display;

means for accumulating an overlap score for each of said selected labels;

means for generating a list of other labels and graphical elements that overlap each of said selected labels;

10 means for comparing a plurality of said lists and accumulating cluster lists of overlapping labels and graphical elements; and

means for sorting a plurality of said cluster lists according to the number of entries in each.

5. The apparatus of Claim 4 wherein said overlap score is based on the degree of severity of overlap between labels and graphical elements.

6. The apparatus of Claim 4 including means for determining that the labels are overlapping other labels or graphical elements when they are mutually overlapping.

7. The apparatus of Claim 4 including means for determining that the labels are overlapping other labels or graphical elements when they are mutually or transitively overlapping.

8. The apparatus of Claim 4 wherein said means for sorting orders the sort from largest cluster list to smallest cluster list.

9. The apparatus of Claim 3 wherein said means for calculating further comprises:

means for comparing the degree of overlap of labels and graphical elements with said new display coordinates and the existing degree of overlap of labels and graphical elements.

10. The apparatus of Claim 3 including means for calculating said new display coordinates according to a stochastic method.

11. The apparatus of Claim 3 including means for calculating said new display coordinates according to a heuristic method.

12. The apparatus of Claim 3 wherein said means for moving further comprises:

means for interpolating a plurality of intermediate display coordinates between the existing display coordinates and said new display coordinates and

5 means for sequentially placing the labels at each of said intermediate display coordinates before placing said labels at said new display coordinates, thereby smoothing the movements of said labels on said display.

13. An apparatus for positioning labels among graphical elements on a computer graphics display, comprising:

means for sequentially selecting labels from a plurality of labels on the display;

5 means for testing each of said selected labels for overlap with other labels and graphical elements in the display;

means for accumulating an overlap score for each of said selected labels;

means for generating a list of other labels and graphical elements that overlap each of said selected labels;

- means for comparing a plurality of said lists and accumulating cluster lists of
10 overlapping labels and graphical elements;
means for sorting a plurality of said cluster lists according to the number of entries
in each;
means for calculating new display coordinates for the labels on a cluster by cluster
basis;
15 means for comparing, on a cluster by cluster basis, the degree of overlap of labels
and graphical elements with said new display coordinates and the existing degree of
overlap of labels and graphical elements, and if the new coordinates result in a reduction
of the degree of overlap; and
means for moving the graphical elements to new positions according to said
20 calculated display coordinates.

14. The apparatus of Claim 13 wherein said overlap score is based on the degree
of severity of overlap between labels and graphical elements.

15. The apparatus of Claim 13 wherein labels are determined to be overlapping
other labels or graphical elements when they are mutually overlapping.

16. The apparatus of Claim 13 wherein labels are determined to be overlapping
other labels or graphical elements when they are mutually or transitively overlapping.

17. The apparatus of Claim 13 wherein said means for sorting orders the sort
from largest cluster list to smallest cluster list.

18. The apparatus of Claim 13 wherein said new display coordinates are
calculated according to a stochastic apparatus.

19. The apparatus of Claim 13 wherein said new display coordinates are calculated according to a heuristic apparatus.

20. The apparatus of Claim 13 wherein said calculating of new display coordinates is ordered according to said cluster list.

21. The apparatus of Claim 13 wherein said means for moving further comprises:
means for interpolating a plurality of intermediate display coordinates between the existing display coordinates and said new display coordinates and

5 means for sequentially placing the labels at each of said intermediate display coordinates before placing said labels at said new display coordinates, thereby smoothing the movements of said labels on said display.

22. A method of positioning labels among graphical elements on a computer graphics display, comprising the steps of:

identifying at least a first cluster of overlapping labels and graphical elements;
calculating new display coordinates for at least one label in said cluster; and
5 moving said label in accordance with said new display coordinates.

23. The method of Claim 22 wherein said identifying step further comprises the steps of:

sequentially selecting labels from a plurality of labels on the display;
testing each of said selected labels for overlap with other labels and graphical
5 elements in the display;
accumulating an overlap score for each of said selected labels;

generating a list of other labels and graphical elements that overlap each of said selected labels;

- 10 comparing a plurality of said lists and accumulating cluster lists of overlapping labels and graphical elements; and
- sorting a plurality of said cluster lists according to the number of entries in each .

24. The method of Claim 23 wherein said overlap score is based on the degree of severity of overlap between labels and graphical elements.

25. The method of Claim 23 wherein labels are determined to be overlapping other labels or graphical elements when they are mutually overlapping.

26. The method of Claim 23 wherein labels are determined to be overlapping other labels or graphical elements when they are mutually or transitively overlapping.

27. The method of Claim 23 wherein said sorting is ordered from largest cluster list to smallest cluster list.

28. The method of Claim 22 wherein said calculating step further comprises the step of:

- comparing the degree of overlap of labels and graphical elements with said new display coordinates and the existing degree of overlap of labels and graphical elements,
- 5 and if the new coordinates result in a reduction of the degree of overlap, proceeding to said moving step.

29. The method of Claim 22 wherein said new display coordinates are calculated according to a stochastic method.

30. The method of Claim 22 wherein said new display coordinates are calculated according to a heuristic method.

31. The method of Claim 22 wherein said moving step further comprises the steps of:

interpolating a plurality of intermediate display coordinates between the existing display coordinates and said new display coordinates, and

5 sequentially placing the labels at each of said intermediate display coordinates before placing said labels at said new display coordinates, thereby smoothing the movements of said labels on said display.

32. A method of positioning labels among graphical elements on a computer graphics display, comprising the steps of:

sequentially selecting labels from a plurality of labels on the display;

5 testing each of said selected labels for overlap with other labels and graphical elements in the display;

accumulating an overlap score for each of said selected labels;

generating a list of other labels and graphical elements that overlap each of said selected labels;

10 comparing a plurality of said lists and accumulating cluster lists of overlapping labels and graphical elements;

sorting a plurality of said cluster lists according to the number of entries in each

calculating new display coordinates for the labels on a cluster by cluster basis;

comparing, on a cluster by cluster basis, the degree of overlap of labels and graphical elements with said new display coordinates and the existing degree of overlap

15 of labels and graphical elements, and if the new coordinates result in a reduction of the degree of overlap; and

moving the graphical elements to new positions according to said calculated display coordinates.

33. The method of Claim 32 wherein said overlap score is based on the degree of severity of overlap between labels and graphical elements.

34. The method of Claim 32 wherein labels are determined to be overlapping other labels or graphical elements when they are mutually overlapping.

35. The method of Claim 32 wherein labels are determined to be overlapping other labels or graphical elements when they are mutually or transitively overlapping.

36. The method of Claim 32 wherein said sorting is ordered from largest cluster list to smallest cluster list.

37. The method of Claim 32 wherein said new display coordinates are calculated according to a stochastic method.

38. The method of Claim 32 wherein said new display coordinates are calculated according to a heuristic method.

39. The method of Claim 32 wherein said calculating of new display coordinates is ordered according to said cluster list.

40. The method of Claim 32 wherein said moving step further comprises the steps of:

interpolating a plurality of intermediate display coordinates between the existing display coordinates and said new display coordinates, and

- 5 sequentially placing the labels at each of said intermediate display coordinates before placing said labels at said new display coordinates, thereby smoothing the movements of said labels on said display.

41. The method of Claim 32, further comprising the step of repeating the foregoing sequence of steps through a plurality of iterations.